REVIEWER´S EVALUTION OF MASTER THESIS

I. IDENTIFICATION DATA

Title:	**Improvement of the production line of motor**
Author:	**Selvan Laxminarayanan**
Type of thesis:	Master
Faculty/department:	Faculty of Mechanical Engineering
Department:	Department of Process Engineering
Reviewer:	assoc. prof. Ing. Lukáš Krátký, Ph.D.
Reviewer´s place of employment:	FME CTU in Prague, Department of Process Engineering

II. EVALUATION CRITERIONS

Master thesis assignment **Standard**

The difficulty of bachelor thesis assignment.

The scope of the thesis was to analyse current layout used in a motor production line, and to propose an optimised design to increase its capacity to the demanded value 1400 pieces per day.

Fulfilment of the thesis´s assignment **Fulfilled with significant reservation**

Evaluate whether the proposed final work fulfils the assignment. Comment where appropriate, points of reference that were not fully met, or if the work is extended compared to a task. If the task is also not wholly fulfilled, try to assess the importance, impact and possibly cause various deficiencies.

The main tasks of this thesis were to (1) make a literature search focused on types of production layouts, to (2) define a current plan, to (3) design a new arrangement to reach given capacity, and to (4) discuss its benefits. All this problem was addressed in individual chapters and subchapters. Nevertheless, there is no information about process timing, no respect to ergonomics and finally demanded production 1400 pieces was not reached by proposed design, just increase from 1260 to 1323 pieces. The tasks of the thesis were, therefore fulfilled with significant reservations.

Procedure and methods for thesis´s solution **Partially correct**

Consider whether the student has chosen the correct procedure and methods for thesis´s solution

The author´s approach was partially right. There is absolutely no information about detail timing of individual workstations – handling, mounting, handling, service and maintenance. The ergonomic standards were not taken into account in my eyes.

Professional level **E–Sufficient**

Assess the expertise level of a thesis, using knowledge gained from the study of scientific literature, documentation and utilisation of data obtained from the practice.

The author firstly presents a fundamental review about line layout strategies, their characteristics, and design using the form of a process flow diagram. Practical part aims to increase capacity from 1250 to 1400 pieces per shift. This should be reached by measuring cycle time, by determining factors of production efficiency that led to the design and implement U-shape assembly line layout. The thesis has no information about measuring cycle time that is crucial for successful improvement of the process line. Just some numbers without any statistical analysis are present. The presented cycle times are therefore overtaken from uncited source or not explained, how the student got them with precision to 3 decimals. Time optimisation of 8P and 9P steps is also amazing. As for U-shape, I think that the ergonomic standards were not taken into account.

Formal and language level **C–Good**

Assess formal correctness in the bibliography, the typographical and linguistic aspects of the thesis.

The thesis contains all the necessary formal requirements. The text is written clearly, concisely and understandably. There are troubles with reference style and Equation formulas; all are labelled in the printed version of the master thesis.

Bibliography **E–Sufficient**

Comment the student's activity during the acquisition and use of learning materials to solve the thesis. Characterise the se-

lection of sources. Assess whether the student made use of all relevant sources. Verify that adopted information is properly distinguished from student´s results and considerations, whether citation forms correspond with ethics, whether bibliographic citations are complete and finally whether all citation is following the practices and standards.

The author used relevant 25 references in the text, mainly websites and papers, no professional books. Citations in the manuscript and their format listed in the bibliography are following the European Copyright Act No. 121/2000 and even with all the citation practices. Nevertheless, it is sometimes not clear, where information was found in some parts of the text, in a practical section especially. Plagiarism Checker Grammarly also checked the thesis with no detection of plagiarism.

Other comments

Comment the level achieved significant results of the final work, e.g. the level of theoretical results, or the functional level of technical solutions, publication outlets, experimental skills, etc.

III. FINAL EVALUATION AND PROPOSAL OF CLASSIFICATION

Summarise aspects of the thesis that most influenced your final evaluation.

The master thesis of Mr Selvan Laxminarayanan scoped to (1) make a literature search focused on types of production layouts, to (2) define the current layout, to (3) design a new arrangement to reach given capacity, and to (4) discuss its benefits. I appreciate a fundamental review about line layout strategies, their characteristics, and design using the form of a process flow diagram. Practical part aims to increase capacity from 1250 to 1400 pieces per shift. I agree with the proposed methodology that this should be reached by measuring cycle time, by determining factors of production efficiency that led to the design and implement U-shape assembly line layout. The thesis has absolutely no information about measuring cycle time that is crucial for successful improvement of process line. Just some numbers without any statistical analysis are present. The presented cycle times are therefore overtaken from uncited source or not explained, how the student got them with precision to 3 decimals. Time optimization of 8P and 9P steps is also amazing. As for U-shape, I think that the ergonomic standards were not taken into account.

Finally concluded, the topic itself has the potential of quality master thesis. The student´s approach to optimize processing line was correct. Nevertheless, the thesis is written superficially. It contains plenty of unjustified considerations and dates. The demanded production 1400 pieces was not reached by the proposed design, just increase from 1260 to 1323 pieces. Based on its quality, I evaluate it as the reviewer by the grade **E – sufficient**.

Question for defence:

1. Could you please explain how did you get cycle times of all the work stations? Discuss a principle of measurement, data mining, and effect of statistical analysis to your results.
2. The time optimisation of step 8P and 9P is confusing. Workstation 9P: “The operator takes three M3.5 screws and mounts it to gearbox cover”. This step is moved to 8P, i.e. time reduction from 13.51 s to 4.38 s, i.e. by 9 s, is reached in 9P. Step 8P including this moved screw mounting was increased from 12.26 s to 15.61 s, i.e. only by 3.5 s. Can you explain this disproportion in cycle timings for optimised 8P and 9P?
3. Discuss your design of U-shape line concerning ergonomic demand using ergonomic standards.
4. Can you explain the difference “my personal design of U-shaped line layout” (appendix 1) and “U-shape line layout with dimension (appendix 3)”? What is your own work? Figure labelling is in the Czech language.
5. The aim to increase capacity from 1250 to 1400 pieces per shift was not reached your optimisation. Could you discuss a vision how to modify your line to fulfil this condition?

Date: 28.1.2020 Signature: assoc. prof. Ing. Lukáš Krátký, Ph.D.